

### Remarks

Claims 16–46 are pending in the application. Claims 21, 23, 24, 35, and 38 are withdrawn from consideration, and claims 16–20, 22, 25–34, 36, 37 and 39–46 are rejected. Claim 29 also is objected to. Applicants respectfully request reconsideration of the claims.

#### *I. Rejections Under 35 U.S.C. § 112*

Claims 16–20, 22, 29–34, 36 and 37–46 are rejected as allegedly not complying with one or more requirements of 35 U.S.C. § 112. Applicants traverse each rejection under 35 U.S.C. § 112 as set forth below.

##### *A. Alleged Lack of Enablement*

Claims 16–20, 22, 29–34, 36 and 37–46 are rejected under 35 U.S.C. § 112, first paragraph, as allegedly failing to comply with the enablement requirement. Applicants traverse these rejections and request that they be withdrawn.

The Office action alleges that as to claims 16 and 29 the term "a portion of said stream of fast neutrons" is not adequately described or enabled by the application. Applicants disagree. The relevant portion is described throughout applicants' specification so as to be entirely clear to those of skill in the art. Nonetheless, solely to expedite prosecution, applicants have amended claims 16 and 29 as reflected in the foregoing listing of claims. Specifically, in claim 16, the cited language has replaced with "detecting a thermalized neutron that is backscattered." Claim 29 has been similarly amended to recite "a backscattered thermalized neutron contacts said neutron sensor." Applicants submit that claims 16 and 29, as amended, comply with 35 U.S.C. §

112, first paragraph, and respectfully request that the rejection of claims 16–20, 22, 29–34, 36 and 37–46 under this section be withdrawn.

*B. Alleged Indefiniteness*

Claims 16–20, 22, 25–34, 36, 37 and 39–46 are rejected under 35 U.S.C. § 112, second paragraph as allegedly being indefinite. Applicants traverse this rejection and request that it be withdrawn.

The Office action alleges that claims 16 and 29 are indefinite with regard to the feature "a portion of said stream of fast neutrons" and specifically alleges that it is not known what is encompassed by this phrase. Applicants maintain that claims 16 and 29 are definite both alone and in view of the specification. Applicants have nonetheless amended claims 16 and 29 as detailed above. Applicants submit that claims 16 and 29, as amended, comply with 35 U.S.C. § 112, second paragraph, and accordingly request that the rejection claims 16–20, 22, 25–34, 36, 37 and 39–46 under this section be withdrawn.

Claim 19 also is rejected because the term "upper level discriminator setting" allegedly renders claim 19 indefinite. The Examiner alleges that Fig. 6b does not support this feature because this chart was taken without using an upper level discriminator setting. However, as explained in the specification, comparing Fig. 6b to Fig. 6c, which is a chart taken using an upper level discriminator setting, illustrates the effect of the upper level discriminator setting (see, page 23, lines 3–26). This feature is further explained throughout the specification, for example at page 6, lines 2–8. Applicants therefore respectfully request the rejection of claim 19 as being indefinite be withdrawn.

The Office action also states that there is no antecedent basis for “upper discriminator setting” in claim 19. However, the claim recites “an upper level discriminator setting.” Thus, it is unclear how this term lacks antecedent basis in claim 19.

Claim 42 also is rejected as allegedly being indefinite. Specifically the Office action states that there is insufficient antecedent basis for “vehicle with extension arm” as recited in line 2 of the claim. However, the claim actually states “a vehicle with an extension arm.” Therefore, it still is unclear how this term requires an antecedent. Applicants respectfully request that the rejection of claim 42 as allegedly being indefinite due to lack of antecedent basis be withdrawn. If there is in fact a lack of antecedent basis in claim 19 or claim 42, applicants request that the Examiner suggest suitable corrections to any antecedent problems as mandated by M.P.E.P. § 2175.03(e).

## ***II. Rejections Under 35 U.S.C. § 102***

Claims 16–20 22, 25–33 and 43 are rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by U.S. Patent No. 4,864,142 to Gomberg (Gomberg) or by U.S. Patent No. 5,200,626 to Schultz (Schultz). Applicants traverse this rejection and request that it be withdrawn because Gomberg and Schultz fail, independently or in combination, to teach or suggest all of the features of the pending claims.

### ***A. Rejections over Gomberg***

Gomberg is directed to detecting scattering of neutrons from elemental nuclei, specifically carbon, nitrogen, oxygen, sulfur, potassium and beryllium. Gomberg, column 6, line 58–column 7, line 10. As recognized by the Examiner, Gomberg describes the emission of

nanosecond bursts and constraining detection to the time required for round trip travel of fast neutrons. *See*, Gomberg, column 11, line 35–40 (stating "the detector 20 is energized in synchrony so as to detect only those neutrons in a particular burst and having a transit time equal to the interval required to travel from the source to the object 22 being interrogated and back to the detector."). However, no neutrons backscattered from hydrogen can be detected in Gomberg's time interval because neutrons backscattered from hydrogen will only arrive after this interval closes.<sup>1</sup> In contrast, the claimed method is directed to detecting neutrons that return after a time delay sufficient for (1) a fast neutron to travel from the source to the target (2) the neutron to undergo multiple scattering events with hydrogen, and (3) for the slowed neutron to return to the detector. As explained in the present application, the present method "does not register any neutrons that return to the neutron sensor during the time delay," because most of these neutrons are "fast neutrons that were not scattered from hydrogenous materials." Specification, page 5, lines 21–24.

The neutrons detected in the present method arrive at the detector after neutrons back scattered by heavier elements do because these neutrons have undergone multiple scattering events and have a longer transit time from the target to detector. To further emphasize this point applicants have amended claims 16 and 29 to recite "detecting a thermalized neutron." Gomberg fails to teach detecting any such neutrons.

The Examiner relies on column 9, line 40, for the proposition that "Gomberg specifically discloses detection of hydrogenous materials." This statement is incorrect. The cited text states

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<sup>1</sup> The nuclei being detected by Gomberg all are significantly heavier than a neutron. As a result, a neutron colliding with these nuclei can be directly backscattered without significant loss of speed. Thus, the time scale for detecting such nuclei is the round-trip travel time for fast neutrons. Because hydrogen has a similar mass as a neutron, multiple scattering events must occur. Because the neutrons backscattered by hydrogen have been slowed and have undergone multiple scattering events, detection of these neutrons occurs later than neutrons backscattered by heavier elements, such as those analyzed by Gomberg

"[d]issociating type explosives have a carbon to nitrogen ratio which is between 0 and 0.5 and a hydrogen-nitrogen ratio which is between 0.5 and 2.0." Nowhere does Gomberg teach detecting hydrogen or determining a hydrogen-nitrogen ratio. Moreover, Gomberg's method specifically excludes the detection hydrogen via backscattering because a single collision of a fast neutron with hydrogen cannot result in backscatter and Gomberg's time window closes before any multiply-scattered, thermalized neutrons could return to the detector.

Independent claim 25 is patentable over Gomberg for the reasons stated above, and further in view of other features recited in this claim. For example, claim 25 recites "providing a timing signal indicative of the interrogating." This feature is described in detail on page 14, lines 3-5, which describes "a source that provides a distinct electronic signal for each fission event resulting in the emission of a neutron." One example of such a timing signal is a gamma ray emitted at the same time a neutron is emitted, which provides a distinct timing signal. Gomberg fails to teach, nor does the Examiner contend that Gomberg teaches, such a timing signal. Accordingly, claim 25 and its dependents, claims 26-28, are further patentable over Gomberg in view of this feature.

*B. Rejections over Schultz*

Schultz not only fails to teach or suggest measuring backscattered neutrons but also fails to teach or suggest employing a time delay for such a measurement as is recited in independent claims 16, 25 and 29. As the Examiner points out, Schultz describes hydrogen density imaging using fast neutrons at column 3, lines 57+. However, this imaging does not involve the detection of backscattered thermalized neutrons after a time delay as recited in the present claims. Upon

consideration of Schultz as a whole, it is clear that Schultz is directed to detecting fast neutrons, *i.e.*, neutrons that have not been backscattered by hydrogen. For example, Schultz states:

“For producing a hydrogen density image, a plurality of neutron detectors 40 are provided, also connected to the analysis device 32. Preferably, the neutron detectors 40 comprise helium-3 tubes wrapped in appropriate moderating material, or appropriately embedded within the chamber neutron-moderating wall material 18. Helium-3 detector tubes inherently detect slow (thermal) neutrons, but tubes wrapped with a[n] absorber (e.g. cadmium) have incident fast neutrons moderated to slow neutrons for detection by the tube. At the same time any incident slow neutrons are blocked entirely from the helium-3 tube detector.”

Schultz, column 8, line 60–column9, line 3 (emphasis added).

Thus, Schultz specifically excludes the possibility of detecting any thermalized (slow) neutrons as claimed by applicants because such neutrons are “blocked entirely” from the detector. In contrast, the present method specifically excludes the detection of fast neutrons by incorporating a time delay. Schultz includes no such time delay.

Because Schultz fails to teach several elements of independent claims 16, 25 and 29, applicants respectfully request that the rejection of these claims and their dependents, *i.e.*, claims 16–20 22, 25–33 and 43 over Schultz under 35 U.S.C. § 102(b) be withdrawn. Moreover, claims 16–20 22, 25–33 and 43 also are patentable in view of additional patentable features and combinations of features recited in those claims.

### ***III. Rejections Under 35 U.S.C. § 103***

Claim 41 is rejected under 35 U.S.C. § 103 as allegedly being unpatentable over Gomberg or Schultz in view of either U.S. Patent No. 3,577,158 to Hahn (Hahn) or 5,083,029 to Buchanan (Buchanan). Applicants traverse this rejection and request that it be withdrawn.

The Office action relies on Hahn and Buchanan to cure the failure of Gomberg and Schultz to teach using a neutron shield comprising  $^{10}\text{B}$ . Even if, assuming solely for the purpose of argument, that Hahn and/or Buchanan teach this feature and are properly combinable with Gomberg or Schultz, the proposed combination still fails to teach or suggest all of the elements recited in Applicants' claims. Neither Hahn nor Buchanan can cure the deficiencies of Gomberg and Schultz to teach or suggest measuring backscattered, thermalized neutrons after a time delay or providing a distinct timing signal. Therefore, none of the proposed combinations teach or suggest each feature of applicant's claims as required by 35 U.S.C. § 103 and M.P.E.P. § 2143.03. Accordingly, applicants respectfully request that the rejection of claim 41 under 35 U.S.C. § 103 be withdrawn.

Claims 44–46 are rejected under 35 U.S.C. § 103(b) as allegedly being unpatentable over either Gomberg or Schultz. Applicants traverse these rejections and request that they be withdrawn because the Office action fails to establish a *prima facie* case of obviousness.

To establish *prima facie* obviousness, all claim limitations must be taught or suggested by the prior art. M.P.E.P. § 2143.03. Neither Gomberg nor Schultz teach or suggest all of the features of claims 44–46. Specifically, Gomberg and Schultz fail to teach or suggest measuring thermal neutrons after a time delay sufficient for thermalized neutrons to return to the detector and hence also fail to teach the specific time delays recited in claims 44–46. Moreover, there is no suggestion or motivation present in either Gomberg or Schultz to even include a time delay in their measuring protocols. As is explained by the present specification, the time delay is used so that neutrons backscattered by hydrogenous materials are detected. Because neither Schultz nor Gomberg is directed to detecting neutrons backscattered by hydrogen, neither reference provides any suggestion or motivation to incorporate a time delay, much less the time delays recited in

claims 44-46. Accordingly, a *prima facie* case of obviousness has not been established over Gomberg and/or Schultz, and applicants respectfully request that the rejections of claims 44-46 be withdrawn.

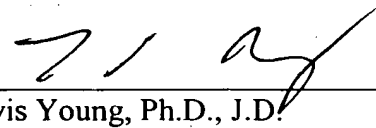
**Conclusion**

Applicants submit that claims 16-20, 22, 25-34, 36, 37 and 39-46 are in condition for allowance. Such action is respectfully requested. Moreover, applicants request that withdrawn claims 21, 23, 24, 35 and 38 be reinstated and examined in the present application upon the allowance of a generic claim.

Respectfully submitted,

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